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## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<b>(51) International Patent Classification <sup>6</sup>:</b> <b>B29C 55/02, C08J 7/04, C09D 167/02</b>	<b>A1</b>	<b>(11) International Publication Number:</b> <b>WO 96/19333</b> <b>(43) International Publication Date:</b> 27 June 1996 (27.06.96)
<b>(21) International Application Number:</b> PCT/GB95/02928 <b>(22) International Filing Date:</b> 15 December 1995 (15.12.95)  <b>(30) Priority Data:</b> 9425641.9                      20 December 1994 (20.12.94)    GB  <b>(71) Applicant (for all designated States except US):</b> IMPERIAL CHEMICAL INDUSTRIES PLC (GB/GB); Imperial Chem- ical House, Millbank, London SW1P 3JF (GB).  <b>(72) Inventors; and</b> <b>(75) Inventors/Applicants (for US only):</b> JEFFELS, Pamela, Moira [GB/GB]; Quarry House, Back Lane, Skelton, Saltburn, Cleveland TS12 2BX (GB). GOUGH, Thane, Colin [GB/GB]; 7 Groston Close, Guisborough, Cleveland TS14 7BP (GB). HART, Charles, Richard [GB/GB]; 16 Linden Close, Hutton Rudgby, Yarm, Cleveland TS16 0HX (GB).  <b>(74) Agents:</b> HUMPHRIES, Martyn et al.; ICI Materials, Intellectual Property Dept., P.O. Box 90, Wilton, Middlesbrough, Cleveland TS90 8JE (GB).		<b>(81) Designated States:</b> AU, BR, CA, CN, JP, KR, US, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).  <b>Published</b> <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>
<b>(54) Title:</b> POLYMERIC FILM COATED WITH A POLYESTER COMPOSITION  <b>(57) Abstract</b>  A polymeric film has a substrate layer of polymeric material and a coating layer containing a copolyester obtainable by polymerising (a) 40 to 90 mole % of at least one aromatic dicarboxylic acid and/or ester forming derivative thereof, (b) 10 to 60 mole % of at least one aliphatic dicarboxylic acid and/or ester forming derivative thereof, (c) 0.1 to 10 mole % of at least one dicarboxylic acid and/or ester forming derivative thereof comprising a free acid group and/or a salt thereof, (d) 40 to 90 mole % of at least one glycol having from 2 to 12 carbon atoms, and (e) 10 to 60 mole % of at least one polyalkylene glycol. The coated film is suitable for use as a lid for a container, particularly for food, exhibiting a strong heat-seal and easy peeling property.		

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## Polymeric film coated with a polyester composition

This invention relates to a polymeric film, and in particular to a coated polyester film which is suitable for use as a lid for a container.

Plastic containers have been increasingly used in packaging applications, such as food packaging, and in particular for packaging convenience foods, for example microwavable ready-prepared meals. The use of plastic containers has led to a requirement for lids which can both seal the container, in order to prevent leakage of the packaged contents during storage, and also be easily peeled off on opening. The lids normally comprise a flexible substrate and a sealable coating layer. The seal can be formed by placing the lid on top of the container and applying heat and pressure in order to soften or melt the sealable coating layer so that it adheres to the surface of the container and forms an effective seal between the lid and the container. Unfortunately, a seal which is strong enough to prevent leakage of the contents often results in difficulties in removing the lid when the container is to be opened. A strong seal and easy peeling properties, ie a clean peel, are required at both low, eg ambient, and high temperatures, eg after heating the packaged food contents in a microwave oven.

Oriented polymeric film, particularly biaxially oriented polyester film, has been used as the flexible substrate for lids for containers. Prior art sealable layers used on lids for containers have generally been coated on polymeric film "off-line", ie after any stretching operation employed during the manufacture of the film. There is a commercial advantage, due to the reduction in the number of process steps employed, in being able to produce an "in-line" coated film, ie before, during or between any stretching operation employed. Unfortunately, prior art sealable layers having the required seal and peeling properties have only been coatable from organic solvent, which is not suitable for "in-line" coating, and/or cause sticking or blocking of the film during the normal winding operations used during film manufacture.

We have now devised a coated polymeric film which reduces or substantially overcomes at least one of the aforementioned problems.

Accordingly, the present invention provides a polymeric film comprising a substrate layer of polymeric material having on at least one surface thereof a coating layer comprising a copolyester obtainable by polymerising (a) 40 to 90 mole % of at least one aromatic dicarboxylic acid and/or ester forming derivative thereof, (b) 10 to 60 mole % of at least one aliphatic dicarboxylic acid and/or ester forming derivative thereof, (c) 0.1 to 10 mole % of at least one dicarboxylic acid and/or ester forming derivative thereof comprising a free acid group and/or a salt thereof, (d) 40 to 90 mole

% of at least one glycol having from 2 to 12 carbon atoms, and (e) 10 to 60 mole % of at least one polyalkylene glycol.

5 The invention also provides a method of producing a polymeric film by melt extruding a substrate layer of polymeric material, and applying to at least one surface thereof a coating layer composition, prior to commencement of or during any stretching operation employed to orientate the substrate, the coating layer composition comprising a copolyester obtainable by polymerising (a) 40 to 90 mole % of at least one aromatic dicarboxylic acid and/or ester forming derivative thereof, (b) 10 to 60 mole % of at least one aliphatic dicarboxylic acid and/or ester forming derivative  
10 thereof, (c) 0.1 to 10 mole % of at least one dicarboxylic acid and/or ester forming derivative thereof comprising a free acid group and/or a salt thereof, (d) 40 to 90 mole % of at least one glycol having from 2 to 12 carbon atoms, and (e) 10 to 60 mole % of at least one polyalkylene glycol.

15 The invention further provides a sealed container comprising a receptacle containing food or drink, and a lid formed from a polymeric film comprising a substrate layer of polymeric material having on at least one surface thereof a coating layer comprising a copolyester obtainable by polymerising (a) 40 to 90 mole % of at least one aromatic dicarboxylic acid and/or ester forming derivative thereof, (b) 10 to 60 mole % of at least one aliphatic dicarboxylic acid and/or ester forming derivative  
20 thereof, (c) 0.1 to 10 mole % of at least one dicarboxylic acid and/or ester forming derivative thereof comprising a free acid group and/or a salt thereof, (d) 40 to 90 mole % of at least one glycol having from 2 to 12 carbon atoms, and (e) 10 to 60 mole % of at least one polyalkylene glycol.

25 The substrate is a "self-supporting film or sheet" by which is meant a film or sheet capable of independent existence in the absence of a supporting base.

A substrate for use in the production of a coated polymeric film according to the invention suitably comprises any synthetic, film-forming, polymeric material. Suitable thermoplastics, synthetic, materials include a homopolymer or a copolymer of a  
30 1-olefine, such as ethylene, propylene or butene-1, a polyamide, a polycarbonate, and particularly a synthetic linear polyester which may be obtained by condensing one or more dicarboxylic acids or their lower alkyl (up to 6 carbon atoms) diesters, eg terephthalic acid, isophthalic acid, phthalic acid, 2,5-, 2,6- or 2,7-naphthalene dicarboxylic acid, succinic acid, sebacic acid, adipic acid, azelaic acid, 4,4'-diphenyldicarboxylic acid, hexahydro-terephthalic acid or  
35 1,2-bis-p-carboxyphenoxyethane (optionally with a monocarboxylic acid, such as pivalic acid) with one or more glycols, eg ethylene glycol, 1,3-propanediol,

1,4-butanediol, neopentyl glycol and 1,4-cyclohexanedimethanol. A polyethylene terephthalate or polyethylene naphthalate film is preferred. A polyethylene terephthalate film is particularly preferred, especially such a film which has been  
5 biaxially oriented by sequential stretching in two mutually perpendicular directions, typically at a temperature in the range 70° to 125°C, and preferably heat set, typically at a temperature in the range 150° to 250°C, for example as described in GB-838708.

The polymeric film substrate may also comprise a polyarylether or thio analogue thereof, particularly a polyaryletherketone, polyarylethersulphone,  
10 polyaryletheretherketone, polyaryletherethersulphone, or a copolymer or thioanalogue thereof. Examples of these polymers are disclosed in EP-A-1879, EP-A-184458 and US-A-4008203. The polymeric film may comprise a poly(arylene sulphide), particularly poly-p-phenylene sulphide or copolymers thereof. Blends of the aforementioned polymers may also be employed.

Suitable thermoset resin polymeric substrate materials include  
15 addition-polymerisation resins, such as acrylics, vinyls, bis-maleimides and unsaturated polyesters; formaldehyde condensate resins, such as condensates with urea, melamine or phenols, cyanate resins, functionalised polyesters, polyamides or polyimides.

The polymeric film substrate according to the invention may be unoriented, or preferably oriented, such as uniaxially oriented or more preferably biaxially oriented by  
20 drawing in two mutually perpendicular directions in the plane of the film to achieve a satisfactory combination of mechanical and physical properties. Simultaneous biaxial orientation may be effected by extruding a polymeric tube which is subsequently quenched, reheated and then expanded by internal gas pressure to induce transverse orientation, and withdrawn at a rate which will induce longitudinal orientation.  
25 Sequential stretching may be effected in a stenter process by extruding the thermoplastics polymer as a flat extrudate which is subsequently stretched first in one direction and then in the other mutually perpendicular direction. Generally, it is preferred to stretch firstly in the longitudinal direction, ie the forward direction through the film stretching machine, and then in the transverse direction. A stretched film may  
30 be, and preferably is, dimensionally stabilised by heat-setting under dimensional restraint at a temperature above the glass transition temperature thereof.

The substrate is suitably of a thickness from 6 to 300 µm, preferably 9 to 150 µm, and more preferably 12 to 40 µm.

The aromatic dicarboxylic acid and/or ester forming derivative thereof,  
35 component (a) of the copolyester of the coating layer includes terephthalic acid, isophthalic acid, phthalic acid, hexahydroterephthalic acid and/or their lower alkyl (up to

6 carbon atoms) diesters, and/or mixtures thereof. Terephthalic acid is particularly preferred. The concentration of the aromatic dicarboxylic acid present in the copolyester is preferably in the range from 45 to 80, more preferably 50 to 70, and particularly 55 to 65 mole % based on all the dicarboxylic acid components of the copolyester.

The aliphatic dicarboxylic acid and/or ester forming derivative thereof, component (b) of the copolyester of the coating layer preferably contains 4 to 20, more preferably 4 to 12, and particularly 5 to 9 carbon atoms. Suitable aliphatic acids includes adipic acid, pimelic acid, suberic acid, azelaic acid, sebacic acid, succinic acid and/or their lower alkyl (up to 6 carbon atoms) diesters, and/or mixtures thereof. Adipic acid is particularly preferred. The concentration of the aliphatic dicarboxylic acid present in the copolyester is preferably in the range from 20 to 55, more preferably 30 to 50, and particularly 35 to 45 mole % based on all the dicarboxylic acid components of the copolyester.

The free acid group-containing, and/or salt thereof, component (c) of the copolyester of the coating layer preferably comprises from 0.3 to 6.0, more preferably 0.5 to 4.0, and particularly 0.7 to 2.0 mole % of at least one dicarboxylic acid and/or ester forming derivatives thereof, based on all the dicarboxylic acid components of the copolyester. By a free acid group is meant a group other than those involved in the polymerisation reaction by which the copolyester is formed. The free acid group may be a carboxylic or preferably a sulphonic acid group and/or salt thereof.

Suitable carboxylic acid containing monomers include 1,2,3-, 1,2,4- and/or 1,3,5-benzene tricarboxylic acid and/or ester forming derivatives thereof.

Dicarboxylic acids containing a sulphonic acid group are preferred, particularly aromatic dicarboxylic acids. Suitable monomers include 4-sulphoisophthalic acid, 5-sulphoisophthalic acid, sulphoterephthalic acid, 4-sulphophthalic acid, 5-sulphophthalic acid, 4-sulphonaphthalene-2,7-dicarboxylic acid and/or the acid anhydrides and/or ester forming derivatives (eg lower alkyl, ie up to 10, preferably up to 6, carbon atoms) thereof, and /or salts thereof. Sulphoisophthalic acid is preferred, and particularly 4-sulphoisophthalic acid. Such acids, and derivatives thereof, are available in salt form, particularly as the alkali metal, and especially sodium, salt, and are conveniently incorporated in salt form into the copolyester of the coating layer. If desired, the alkali metal content of the copolyester can be reduced, for example by deionisation, particularly by passing a solution or dispersion of the copolyester through a mixed bed deionisation column.

The glycol component (d) of the copolyester of the coating layer preferably contains from 2 to 8, more preferably 2 to 4 carbon atoms. The glycol component is preferably an aliphatic glycol, and more preferably an alkylene glycol, and includes ethylene glycol, propylene glycol, 1,3-butane diol, 1,4-butane diol, neopentyl glycol, 1,5-pentane diol, 2,2-dimethyl 1,3-propane diol, diethylene glycol, triethylene glycol and/or mixtures thereof. 1,4-butane diol is preferred, particularly in combination with small amounts of ethylene glycol. The concentration of the glycol component (d) present in the copolyester is preferably in the range from 50 to 85, more preferably 55 to 80, and particularly 70 to 75 mole % based on all the glycol components of the copolyester. The concentration of ethylene glycol is preferably less than 10, more preferably less than 5 mole % based on all the glycol components of the copolyester.

The polyalkylene glycol component (e) of the copolyester of the coating layer includes those having from 2 to 4 carbon atoms in the alkylene moiety, such as polyethylene glycol, polypropylene glycol, poly 1,4-butane diol and/or mixtures thereof. The polyalkylene glycol component may also be a copolymer, preferably a block copolymer, of any of the aforementioned polyalkylene glycols, such as a polyethylene glycol/polypropylene glycol block copolymer. Poly 1,4-butane diol is particularly preferred. The concentration of the polyalkylene glycol present in the copolyester is preferably in the range from 15 to 50, more preferably 20 to 45, and particularly 25 to 30 mole % based on all the glycol components of the copolyester. The molecular weight of the polyalkylene glycol is preferably in the range from 200 to 10,000, more preferably 400 to 5,000, particularly 500 to 1,000, and especially 600 to 800.

A preferred copolyester comprises terephthalic acid as component (a), adipic acid as component (b), sulfoisophthalic acid and/or a salt thereof as component (c), 1,4-butane diol as component (d), and polypropylene glycol or, more preferably poly 1,4-butane diol as component (e). In a further preferred embodiment, component (d) additionally includes a minor amount of ethylene glycol. A particularly preferred copolyester comprises 56 to 60 mole % of terephthalic acid, 40 to 44 mole % of adipic acid, 0.8 to 1.5 mole % of sulfoisophthalic acid and/or a salt thereof, 67 to 71 mole % of 1,4-butane diol, 3 to 5 mole % of ethylene glycol, and 26 to 28 mole % of poly 1,4-butane diol, all based respectively on the total dicarboxylic acid or glycol components of the copolyester.

The copolyester preferably has a glass transition point of less than 10°C, more preferably less than 5°C, particularly in the range from -15°C to 0°C, and especially -10°C to -2°C. If the glass transition point of the copolyester is outside the

aforementioned preferred ranges, deterioration of the peeling property can occur which may ultimately result in a tear instead of a clean peel.

5 The copolyester preferably has a melting point in the range from 120°C to 220°C, more preferably 135°C to 195°C, particularly 150°C to 180°C, and especially 160°C to 170°C. If the melting point of the copolyester is outside the aforementioned ranges an adequate heat-seal may not be obtained. A coated film according to the invention preferably exhibits a heat-seal value of greater than 250, more preferably up to 1000, particularly in the range from 300 to 800, and especially 350 to 450 g/25 mm<sup>2</sup> when sealed to a standard APET/CPET (a composite material having an amorphous  
10 polyethylene terephthalate layer on top of a crystalline polyethylene terephthalate layer) tray.

The weight average molecular weight of the copolyester is preferably in the range from 5,000 to 40,000, more preferably 10,000 to 30,000, particularly 15,000 to 25,000, and especially 18,000 to 22,000.

15 The copolyester component of the coating layer preferably has a degree of crystallinity in the range from 5 to 45%, more preferably 20 to 45%, particularly 20 to 40%, and especially 25 to 35%.

Formation of the copolyester is conveniently effected in known manner by condensation, or ester-interchange, at temperatures generally up to 275°C.

20 If desired, the coating layer composition may also contain a cross-linking agent which functions to cross-link the layer thereby improving adhesion to the polymeric film substrate. Additionally, the cross-linking agent should preferably be capable of internal cross-linking in order to provide protection against solvent penetration. Suitable cross-linking agents may comprise epoxy resins, alkyd resins, amine derivatives such as hexamethoxymethyl melamine, and/or condensation products of an amine, eg  
25 melamine, diazine, urea, cyclic ethylene urea, cyclic propylene urea, thiourea, cyclic ethylene thiourea, alkyl melamines, aryl melamines, benzo guanamines, guanamines, alkyl guanamines and aryl guanamines, with an aldehyde, eg formaldehyde. A useful condensation product is that of melamine with formaldehyde. The condensation  
30 product may optionally be alkoxylated. The cross-linking agent may suitably be used in amounts of up to 50%, preferably up to 40%, more preferably in the range from 10% to 30% by weight relative to the total dry weight of the coating layer. A catalyst is also preferably employed to facilitate cross-linking action of the cross-linking agent. Preferred catalysts for cross-linking melamine formaldehyde include para toluene  
35 sulphonic acid, maleic acid stabilised by reaction with a base, morpholinium paratoluene sulphonate, and ammonium nitrate.



A major proportion of the solvent or liquid present in the coating layer composition is preferably water. The solvent preferably comprises at least 70%, more preferably at least 80%, and particularly at least 85% and up to 100% by weight of water. The solvent of the coating layer composition may comprise a minor proportion of an organic solvent, preferably a high boiling point solvent, for example having a boiling point greater than 120°C, more preferably greater than 150°C. Suitable organic solvents include tertiary butyl cellosolve, n-butyl cellosolve, propyl cellosolve, acetone and cyclohexanone. N-butyl cellosolve is a particularly preferred organic solvent. The concentration of organic solvent present in the coating layer composition is preferably less than 20%, more preferably less than 15%, particularly less than 10%, and especially less than 5% by weight of all the components present in the composition.

The coating layer composition may be applied after, preferably before or during, the stretching operation used in the production of an oriented film. The coating layer composition is preferably applied to the polymeric film substrate between the two stages (longitudinal and transverse) of a thermoplastics polymeric film biaxial stretching operation. Such a sequence of stretching and coating is suitable for the production of a coated linear polyester film, particularly polyethylene terephthalate film, substrate, which is preferably firstly stretched in the longitudinal direction over a series of rotating rollers, coated, and then stretched transversely in a stenter oven, preferably followed by heat setting.

A coated polymeric, especially polyester, substrate is suitably initially heated up to 140°C, preferably up to 120°C in order to dry the aqueous medium and/or organic solvent; followed by heating up to 240°C, preferably up to 220°C in order to assist in coalescing and forming the coating into a continuous and uniform layer. The cross-linking of cross-linkable coating compositions is also achieved at such temperatures, generally at temperatures greater than 150°C.

The coating layer composition is preferably applied to the polymeric film substrate by any suitable conventional technique such as dip coating, bead coating, reverse roller coating or slot coating.

The coating layer is preferably applied to the polymeric substrate at a dry coat weight in the range from 0.3 to 5.0 gm<sup>-2</sup>, more preferably 0.5 to 3.0 gm<sup>-2</sup>, and particularly 1.0 to 2.0 gm<sup>-2</sup>. The thickness of the dry coating layer is preferably in the range from 0.3 to 5.0 µm, more preferably 0.5 to 3.0 µm, and particularly 1.0 to 2.0 µm. For films coated on both surfaces, each coating layer preferably has a coat weight and layer thickness within the preferred ranges.

Prior to deposition of the coating layer onto the polymeric substrate, the exposed surface thereof may, if desired, be subjected to a chemical or physical surface-modifying treatment to improve the bond between that surface and the subsequently applied coating layer. A preferred treatment, because of its simplicity and effectiveness, is to subject the exposed surface of the substrate to a high voltage electrical stress accompanied by corona discharge. Alternatively, the substrate may be pretreated with an agent known in the art to have a solvent or swelling action on the polymeric substrate, for example for a polyester substrate suitable agents include a halogenated phenol dissolved in a common organic solvent eg a solution of p-chloro-m-cresol, 2,4-dichlorophenol, 2,4,5- or 2,4,6-trichlorophenol or 4-chlororesorcinol in acetone or methanol.

One or more of the layers of a polymeric film according to the invention, ie substrate and/or coating layer(s), may conveniently contain any of the additives conventionally employed in the manufacture of polymeric films. Thus, agents such as dyes, pigments, voiding agents, lubricants, anti-oxidants, anti-blocking agents, surface active agents, slip aids, gloss-improvers, prodegradants, ultra-violet light stabilisers, viscosity modifiers and dispersion stabilisers may be incorporated in the substrate and/or coating layer(s), as appropriate. In particular, a polyester substrate may comprise a particulate filler, such as silica or china clay, of small particle size, for example less than 10  $\mu\text{m}$ . Desirably, a filler, if employed in a substrate layer, should be present in a small amount, not exceeding 0.5%, preferably less than 0.2%, by weight of the substrate.

A polymeric film according to the invention may be used in a variety of packaging applications such as for forming a pouch, used for sealing or providing a lid on a container, such as a thermoformed tray, thermoformed bowl or blow-moulded bottle. The container may be formed of polyester, such as polyethylene terephthalate, or of polypropylene, polystyrene, or may be PVDC coated. A film according to the invention is particularly suitable for use as a lid for an APET/CPET container, especially a thermoformed tray, which is suitable for packaging food or drink.

The invention is illustrated by reference to the following example.

#### Example 1

A polyethylene terephthalate film was melt extruded, cast onto a cooled rotating drum and stretched in the direction of extrusion to approximately 3.5 times its original dimensions. The monoaxially oriented polyethylene terephthalate substrate film was coated on one side with a coating composition comprising the following ingredients:

- |   |  |             |
|---|--|-------------|
|   | Vylonal MD 1980*   | 4.37 litres |
|   | (30% w/w aqueous/tertiary butyl cellosolve<br>(85%/15% solvent mixture) dispersion of copolyester,<br>supplied by Toyobo (Osaka, Japan)) |             |
| 5 | Synperonic NP10  | 0.10 litres |
|   | (10% w/w aqueous solution of alkyl phenol<br>ethoxylate, supplied by ICI)  |             |
|   | Demineralised water  | 0.53 litres |
- \* by Applicant's analysis the copolyester present in Vylonal MD 1980 contains 57 mole % of terephthalic acid, 42 mole % of adipic acid, 1 mole % of sulphisophthalic acid and/or a salt thereof, 69 mole % of 1,4-butane diol, 4 mole % of ethylene glycol, and 27 mole % of poly 1,4-butane diol.
- The coated film was passed into a stenter oven, where the film was stretched in the sideways direction to approximately 3.5 times its original dimensions. The coated
- 15 biaxially stretched film was heat set at a temperature of about 220°C by conventional means. Final film thickness was 20 µm. The dry coat weight of the coating layer was approximately 1.5 gm<sup>2</sup>, and the thickness was approximately 1.5 µm.
- The coated film was sealed, by means of the coating layer, to a standard
- 20 APET/CPET tray using a Microseal PA 201 (obtained from Packaging Automation Ltd, England) tray sealer at a temperature of 180°C, and pressure of 80 psi for two seconds. Strips of the sealed film and tray were cut out at 90° to the seal, and the load required to pull the seal apart was measured using an Instron operating at a crosshead speed of 0.2 mmmin<sup>-1</sup>. The procedure was repeated 4 times, and a mean value of the 5 results calculated. The peel strength value obtained was 372 g/25 mm. The peel was clean,
- 25 ie no surface damage was visible to the naked eye on both the separated film and tray. The peel strength was also measured for a sealed tray which had been placed in an oven at 200°C for 20 minutes, in order to simulate the effects of heating any packaged food contents in a microwave oven. The peel strength value after heating was 374 g/25 mm, and again a clean peel was obtained.

- |   |  |             |
|---|--|-------------|
|   | Vylonal MD 1980*   | 4.37 litres |
|   | (30% w/w aqueous/tertiary butyl cellosolve<br>(85%/15% solvent mixture) dispersion of copolyester,<br>supplied by Toyobo (Osaka, Japan)) |             |
| 5 | Synperonic NP10  | 0.10 litres |
|   | (10% w/w aqueous solution of alkyl phenol<br>ethoxylate, supplied by ICI)  |             |
|   | Demineralised water  | 0.53 litres |
- \* by Applicant's analysis the copolyester present in Vylonal MD 1980 contains 57 mole % of terephthalic acid, 42 mole % of adipic acid, 1 mole % of sulphisophthalic acid and/or a salt thereof, 69 mole % of 1,4-butane diol, 4 mole % of ethylene glycol, and 27 mole % of poly 1,4-butane diol.
- 15 The coated film was passed into a stenter oven, where the film was stretched in the sideways direction to approximately 3.5 times its original dimensions. The coated biaxially stretched film was heat set at a temperature of about 220°C by conventional means. Final film thickness was 20 µm. The dry coat weight of the coating layer was approximately 1.5 gm<sup>2</sup>, and the thickness was approximately 1.5 µm.
- 20 The coated film was sealed, by means of the coating layer, to a standard APET/CPET tray using a Microseal PA 201 (obtained from Packaging Automation Ltd, England) tray sealer at a temperature of 180°C, and pressure of 80 psi for two seconds. Strips of the sealed film and tray were cut out at 90° to the seal, and the load required to pull the seal apart was measured using an Instron operating at a crosshead speed of 0.2 mmmin<sup>-1</sup>. The procedure was repeated 4 times, and a mean value of the 5 results calculated. The peel strength value obtained was 372 g/25 mm. The peel was clean,
- 25 ie no surface damage was visible to the naked eye on both the separated film and tray. The peel strength was also measured for a sealed tray which had been placed in an oven at 200°C for 20 minutes, in order to simulate the effects of heating any packaged food contents in a microwave oven. The peel strength value after heating was 374 g/25 mm, and again a clean peel was obtained.

### Claims

1. A polymeric film comprising a substrate layer of polymeric material having on at least one surface thereof a coating layer comprising a copolyester obtainable by polymerising (a) 40 to 90 mole % of at least one aromatic dicarboxylic acid and/or ester forming derivative thereof, (b) 10 to 60 mole % of at least one aliphatic dicarboxylic acid and/or ester forming derivative thereof, (c) 0.1 to 10 mole % of at least one dicarboxylic acid and/or ester forming derivative thereof comprising a free acid group and/or a salt thereof, (d) 40 to 90 mole % of at least one glycol having from 2 to 12 carbon atoms, and (e) 10 to 60 mole % of at least one polyalkylene glycol.
2. A polymeric film according to claim 1 wherein component (a) comprises terephthalic acid and/or ester forming derivative thereof, and/or component (b) comprises adipic acid and/or ester forming derivative thereof.
3. A polymeric film according to either one of claims 1 and 2 wherein component (c) comprises a sulphonic acid group and/or salt thereof.
4. A polymeric film according to any one of the previous claims wherein component (d) comprises 1,4-butane diol and/or component (e) comprises poly 1,4-butane diol.
5. A polymeric film according to any one of the preceding claims wherein the copolyester comprises 56 to 60 mole % of terephthalic acid, 40 to 44 mole % of adipic acid, 0.8 to 1.5 mole % of sulphoisophthalic acid and/or a salt thereof, 67 to 71 mole % of 1,4-butane diol, 3 to 5 mole % of ethylene glycol, and 26 to 28 mole % of poly 1,4-butane diol.
6. A method of producing a polymeric film by melt extruding a substrate layer of polymeric material, and applying to at least one surface thereof a coating layer composition, prior to commencement of or during any stretching operation employed to orientate the substrate, the coating layer composition comprising a copolyester obtainable by polymerising (a) 40 to 90 mole % of at least one aromatic dicarboxylic acid and/or ester forming derivative thereof, (b) 10 to 60 mole % of at least one aliphatic dicarboxylic acid and/or ester forming derivative thereof, (c) 0.1 to 10 mole % of at least one dicarboxylic acid and/or ester forming derivative thereof comprising a free acid group and/or a salt thereof, (d) 40 to 90 mole % of at least one glycol having from 2 to 12 carbon atoms, and (e) 10 to 60 mole % of at least one polyalkylene glycol.
7. A method according to claim 6 wherein the coating layer composition is applied to the substrate between the longitudinal and transverse stretching stages used in the production of a biaxially oriented substrate.

8. A method according to either one of claims 6 and 7 wherein a major proportion of the solvent present in the coating layer composition is water.
9. A sealed container comprising a receptacle containing food or drink, and a lid formed from a polymeric film comprising a substrate layer of polymeric material having on at least one surface thereof a coating layer comprising a copolyester obtainable by polymerising (a) 40 to 90 mole % of at least one aromatic dicarboxylic acid and/or ester forming derivative thereof, (b) 10 to 60 mole % of at least one aliphatic dicarboxylic acid and/or ester forming derivative thereof, (c) 0.1 to 10 mole % of at least one dicarboxylic acid and/or ester forming derivative thereof comprising a free acid group and/or a salt thereof, (d) 40 to 90 mole % of at least one glycol having from 2 to 12 carbon atoms, and (e) 10 to 60 mole % of at least one polyalkylene glycol.
10. A container according to claim 9 wherein the receptacle is an APET/CPET thermoformed tray.

# INTERNATIONAL SEARCH REPORT

International Application No  
PCT/GB 95/02928

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 6 B29C55/02 C08J7/04 C09D167/02

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 B29C C08J C09D C08G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US,A,4 476 189 (POSEY ROBERT G ET AL) 9 October 1984 see column 4, line 18 - line 21; claim 1 ---	1-4,6-10
Y	DATABASE WPI Section Ch, Week 8827 Derwent Publications Ltd., London, GB; Class A23, AN 88-186095 & JP,A,63 122 538 ( TOYOTO KK) , 26 May 1988 see abstract --- -/--	1-4,6-10

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

\* Special categories of cited documents:

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
- \*E\* earlier document but published on or after the international filing date
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- \*O\* document referring to an oral disclosure, use, exhibition or other means
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- \*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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- \*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
- \*A\* document member of the same patent family

Date of the actual completion of the international search

28 March 1996

Date of mailing of the international search report

15. 04 96

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# INTERNATIONAL SEARCH REPORT

Internal Application No  
PCT/GB 95/02928

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	<p>DATABASE WPI Section Ch, Week 9231 Derwent Publications Ltd., London, GB; Class A23, AN 92-255510 &amp; JP,A,04 173 228 ( TEIJIN LTD) , 19 June 1992 see abstract</p>	1-4,6-10
A	<p>EP,A,0 554 654 (DIAFOIL HOECHST CO LTD) 11 August 1993 see example 6</p>	1-10



**INTERNATIONAL SEARCH REPORT**

Information on patent family members

International Application No

PCT/GB 95/02928

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